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Building Information Modelling (BIM) in the Malaysian Architecture Industry

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Abstract: - For the past quarter century, the architecture profession have seen tremendous developments in skills level, work processes and professional culture with the adoption of digital technologies. Investment in technology has always been to improve effectiveness in practice and increase performance in the design/build process that yields a return of investment at the end of the day. Today, more and more digital technologies have been developed and created to accommodate the high demands of the market over the years, including Building Information Modelling (BIM). This research paper aims to look into the insight of how architect firms in Malaysia are coping up with the introduction of BIM in the country. The main approach is by conducting a nationwide survey on all the architectural firms in Malaysia and the findings will be used as a foundation for further research on the matter. High quality research is needed to help justify the usage of this new technology within the country.

Key-Words: - Building Information Model (BIM), Computer Aided Design, Graphic Editor, Software, 2D Drafting, 3D Modeling and Rendering

1 Introduction

Digital technologies have been changing architects' life and way of working for the last few decades. At the start of the new millennium, research and development by the ever demanding market has led to the creation of an even more sophisticated technology that not only change the way architects design but also how the profession works. That technology is called Building Information Modeling (BIM) and Building Performance Simulation (BPS).

Today, BIM is centre-stage within the construction sector the world-over. It is seen as a means to overcome those age-old difficulties in communications and information management that have plagued the architecture industry for decades. Reports and research from around the world shows that BIM has now

gained strong grounds and its numbers of users continue to grow from year to year.

The 2012 SmartMarket Report by McGraw Hill shows that the adoption rate of BIM in the United States has reached 72% [1]. Reports by the same publisher for the same year also states that the adoption rates in Korea is at 58% while the Middle East stands close to 25% [1]. According to a 2010 report, BIM usage in Western Europe has reached 38% [2]. The National Building Specification (NBS), a body owned by the Royal Institute of British Architects (RIBA), reported that the BIM adoption rate in the UK for 2012 stands at 31% [3]. On the Southern Hemisphere, a 2012 national report by Masterspec states that New Zealand has 34% users of BIM while Australia's adoption rate is at 19% [4].

Due to the benefits of BIM and its huge potential of improving the Architecture, Engineering and Construction (AEC) industry, governments of developed and developing countries around the world have also started to mandate the usage of BIM in their respective countries. In the United States, the General Services Administration (GSA) began requiring the use of BIM in all new projects in 2007 [5]. BIM has been compulsory in Finland since 2007 when it comes to the state enterprise Senate Properties that provides property services primarily to government customers [5]. Whereas in Norway, the civil state client *Statsbygg* decided to use BIM for the whole lifecycle of their buildings from 2005 onwards [6]. In 2007, Danish state clients such as the *Palaces & Properties Agency*, the *Danish University Property Agency* and the *Defence Construction Service* require BIM to be used for their projects [7]. The Dutch Ministry of Interior on the other hand, requires BIM to be used for large building maintenance projects in the Netherlands from 2012 onwards [6]. In Asia, where BIM was initially seen as slow to adopt BIM has now taken steps to catching up with the rest by mandating BIM use for public works. The Hong Kong Housing Authority will require BIM for all new projects from 2014 while the Public Procurement Service of Singapore made BIM compulsory for all projects over S\$50 million and for all public sector projects by 2016 [8].

However, whilst BIM have shown promise elsewhere, it has not been the same in Malaysia. As to date, no government agencies or body has mandated the usage of BIM. Research in BIM is also at a low where none of the academic institutions have set up a unit or department that looks into BIM matters. While national scale reports or surveys on BIM usage has been conducted in many developed countries, it has not been the case with Malaysia.

2 Issue

When CAD was introduced to the architecture world about a quarter century ago, the architecture industry in Malaysia took its own time to adopt the new technology. This was probably due to the fact that the medium for the technology, the computer, was also a new technology altogether and a luxury to own such machine. Nevertheless, CAD technology is now used to the fullest by the majority of firms if not all. According to a survey done on Malaysian architecture firms in 2009, AutoCAD by Autodesk is a household item and used by all the respondents in the survey. It also revealed that high end 3D solid and surface modelers were used extensively by the industry [9].

However, BIM and BPS is a different game altogether compared to CAD, CAAD and CAM. It is not a tool that replaces pens and pencils. BIM is much more of a change for the industry than CAD/CAM/CAAD: it reorganizes the sequence, timing, and duration of the design process, ushers in a new model of constant, detailed communication, puts a geometrically larger amount of information into one place, and might even change the fundamental roles of each participating company [10]. A huge amount of investment is required to adopt this new system. Without data, guides and assist, few people can justify their adoption of BIM and those at the forefront of BIM technology may be moving in a direction that does not necessarily lead to success [11].

3 Methodology

Looking to the above matter, it is crucial that a report on the adoption and usage of BIM is produced at a national level as a first step towards developing the future roadmap towards full BIM implementation in the country. For this, a quantitative survey was done on all the architectural firms in Malaysia amounting to 535 firms. All of these firms are registered to the Malaysian Institute of Architects or *Pertubuhan Arkitek Malaysia* (PAM), the professional body for architects in Malaysia. The survey, which was distributed

electronically through emails, was carried out from 18 March 2013 to 17 June 2013, a total period of three (3) months. From the survey, 140 firms responded, which gives a responds rate of 26%. From a demographic aspect, 61% of the responds came from Kuala Lumpur, Malaysia's capital and biggest city.

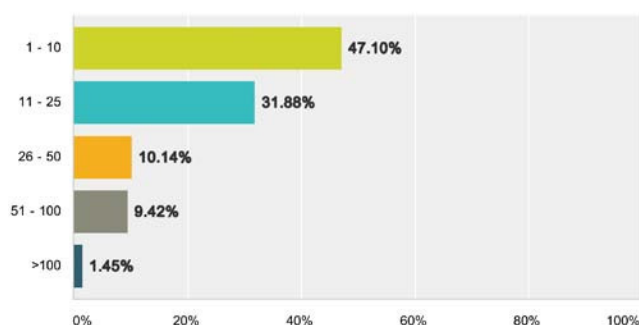
There are two (2) main objectives as to why the survey was carried out. The first objective was to find out the current use of digital technologies in practice. This includes the types of computer application used in offices and categorizing it into primary and secondary usage. The survey also gives insights into the impacts that these technologies are having on design strategies, associated management structures and cultures within the industry. The second objective of this survey was to explore the usage of BIM within the industry. This will also provide an insight into the impacts that BIM are having on design strategies, associated management structures and cultures among the firms.

The results obtained from this survey have provided the Malaysian Institute of Architects an insight which would help enable them to take further actions in promoting the adoption of BIM within the architecture industry in the country.

4 Findings and Analysis

Q3 Including yourself, approximately how many people... - are employed in your firm?

Answered: 138 Skipped: 2



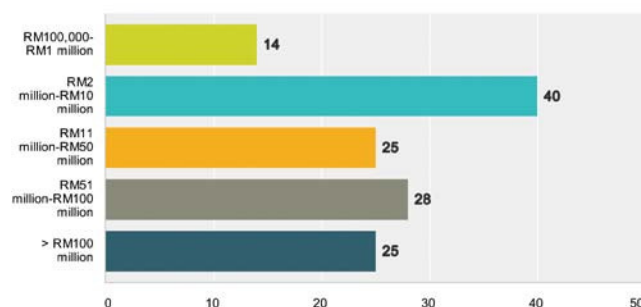
Firms with not more than 10 employees make up the majority at 47% of the sample, followed by firms with 11-25 employees at 32%, and firms with 26-50 employees at 10%. Bigger

firms with 51 to 100 employees' makes up only 9% of the sample. Firms with the more than 100 employees made up the lowest respond rate at only 1.5%. With this, it shows a trend that the responds rate decreases as from smaller firms to bigger firms.

85 respondents reported that the majority of their projects come from the private sector whereas 45 respondents reported having public or government funded projects as their main source of projects. It is noticeable that only 1 respondent is concentrating on renovation projects while none from the sample are focusing on conservation works. This somehow shows that a young and developing country like Malaysia focuses more on new projects and unlike most European and North American countries, most of its buildings in the urban areas are less than 100 years old and considered not old enough to carry substantial heritage values.

Q6 Value of all active projects (current and completed projects within the last 12 months)

Answered: 132 Skipped: 8



The majority of respondents, which represent 30% of the sample, currently run projects worth between RM2-RM10 million. Other respondents above that category are equally

distributed with each of the 3 other category having 25-28 respondents, or roughly 20% of the sample. This includes firms with active projects that cost more than RM100 million (£23 million). Even though small firms make up to nearly 60% of the respondents, the size and value of projects can be seen as being more equally distributed among the respondents.

This question is one of the most important questions in the survey as the finding relatively answers the first objective of the research. The above figure shows the types of software applications that the architecture firms mainly used to produce CAD drawings. CAD drawings by definition means drawings used for construction and documentation purpose. Based on the responds, *AutoCAD* by *Autodesk* has the highest respondents with a total of 107, representing 82% of the sample. Next in second place is *Sketchup* with 13 respondents, 10% of the sample.

The huge difference on the nos. of users between *AutoCAD*, which sits at first place, and its closest rival shows that *AutoCAD* seems to be dominating the current CAD market and thus setting up a standard for the industry for 2D software. There may be a number of reasons as

to why this happens. *AutoCAD*, a software traditionally used for the production of 2D drawings, was one of the first 2D drafting application introduced in the country. Therefore, being the earliest 2D drafting application, coupled with tremendous marketing effort during its introduction, the *AutoCAD* name has been synonymous to architects and draftsmen when it comes to 2D drafting [12].

Apart from that, the transfers of drawing files from one consultant to the other consultants in a construction project during the early years demanded all project team members to use the same software application. This was due to the fact that most software applications stands on its own platform and did not share the same format, making it unable to open and edit drawing files through other different applications. Due to this, *AutoCAD*, which was one of the earliest 2D drafting application to be introduced in the country, set an informal rule that any new office that intends to implement computer drafting has to have *AutoCAD* to be able to read *AutoCAD* drawings that comes from other senior or leading firms. Although this is no longer a problem as most software applications of today are able to read files from other applications, by the time this happens, *AutoCAD* has already been brought and used by most architect firms in the country.

Another revelation by this question was on the usage of Building Information Modeling (BIM). Software that uses BIM platform such as *Autodesk Revit* and *Graphisoft ArchiCAD* enables 2D drawings to be extracted directly from the main master model, thus making 2D software such as *AutoCAD* and *Microstation* redundant and irrelevant to architecture firms that adopt BIM. Based on this result, it is clear that 92% of the respondents may not yet adopt BIM, or at least have not made BIM their main platform for project deliverables.

Based on the result, SketchUp by *Trimble Navigation Ltd.*, which is a 3D software application, founds itself as the most popular secondary or supporting software in the Malaysian market. Although the software is considered relatively new, as its first release in the country was in late the 2000, its popularity rose sharply over the years as many consider its *Push/Pull* Technology (U.S patented 2003) has made it probably the easiest 3D software available on the market. However, as the application is meant for conceptual 3D modelling, as reflected by its name, SketchUp's popularity would most probably stays stagnant due to its inability to provide high-end 3D renderings. This is where 3D modelling and rendering software such as *Autodesk's* 3D Studio Max and Cinema4D by *Maxxon* comes in. Most SketchUp users end up having their 3D models rendered in these applications due to their high-end renderings ability.

Findings from this result also give an insight on Building Information Modeling, where 31% of the sample reported of adopting BIM technology. Among the BIM software, Revit by Autodesk seems to be the most popular with 27 respondents using it, and followed by ArchiCAD of Graphisoft, Vectorworks and Allplan, both by Nemetschek. Environmental software like IES, EcoDesigner, Ecotect, Green Building Studio, and eQuest, which offers building energy performance simulation, still have a very long way to go from becoming mainstream as only 2 respondents reported of using it.

An architecture firm can choose to use more than one type of digital media for its project deliverables. This may happen for firms that may have different employees with different skills and preferences for specific digital application even though they might all work on the same project. It may also happen that the different types of outputs an architecture firm produces such as 2D drawings, 3D drawings, montage images, virtual reality, simulations, video presentation and so on may result in the usage of different software application that offers different capabilities. An architecture firm that is replacing their main digital application with a new one might do that by first adopting the new technology as a secondary or supporting application before upgrading it to become their main digital application.

Q10 The main factor that drives you to adopt new software/technologies would be..

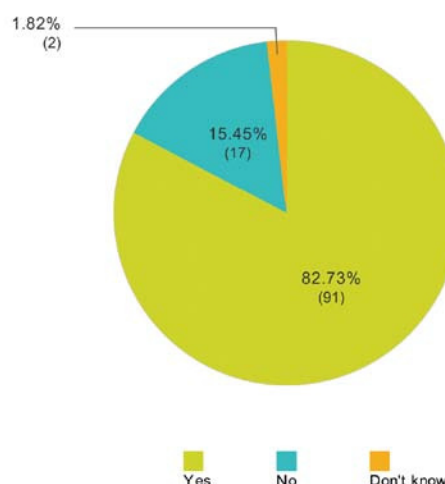
Answered: 111 Skipped: 29

From time to time it is important for business entities to upgrade and update their tools and technology in order for them to keep up the competitive edge that they should have in competing with other players. However, it is important to know what drives these entities to adopt new technologies so that we know which drivers give the best outcome. Based on the figure, adopting new technologies based on the project team's needs scored the highest rating of 4.2 out of a full rating of 5. This seems to be a very positive practice as it is done on a need-based basis.

One point that needs to be look upon with great concern is the fact that 82% of the respondents' decision to adopt new technology lies upon the types of skills graduate posses. This means that the direction of technological path the country goes upon is directly influenced to a certain extend by the HEI. The driver for new technology that received the lowest rating of 2.69 out of 5 is sales pressure by vendors. This is of course a positive sign as commercial marketing might not always be the best reference for a product.

Q11 Had you ever heard of BIM (Building Information Modelling) before taking this survey?

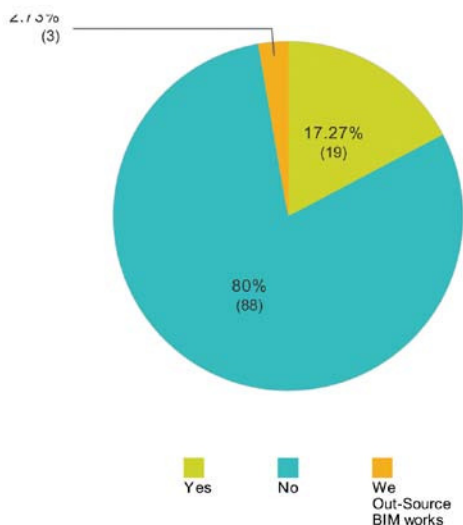
Answered: 110 Skipped: 30



By the time the survey reaches to this question, 30 respondents had opted out of the survey. However, closely to 90% opted to stay on course and continue with the survey through the third segment, which is the most important segment and where the research is centred. The response to this question was overwhelmingly positive whereby 83% of the sample reported as being fully aware of BIM and its capabilities.

Q12 Does your firm currently use BIM for its projects?

Answered: 110 Skipped: 30



This question is relatively the biggest and the most important question of the survey. The response to this question was also a revelation and a concern that needs to be looked and acted upon carefully and effectively. Based on the above figure, while 83% of the sample reported of being aware of BIM, only 20% are actually adopting it in their project deliverables. Needless to say that 14% from those who use BIM opted to out-source BIM works rather than adopting the technology in-house. This figure is a concern if one would compare it to some other parts of the world where the US has nearly 70% of their architects and Europe has 34% of players using BIM. It is also obscure as to why so many people choose not to use it while acknowledging the technology and its qualities.

The responds show us that BIM is still very much new to the architecture industry in Malaysia. Most of the users have been using BIM for not more than 2 years. This indicates that most BIM users in Malaysia are still at a very early stage of implementation. Only 16% of BIM users have used it for more than 4 years.

All 19 respondents had indicated that they would keep on using BIM in the future for their project deliverables. This gives an indication that BIM has given benefits to these architecture firms and that they are content to continue with the adoption of the technology.

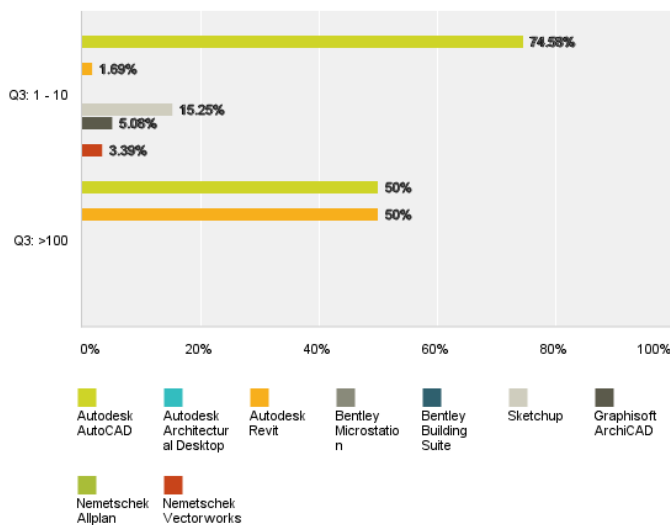
This question reverts back to non-BIM users, which with 92 respondents, forms the majority of the survey's respondents. With 83% of respondents having full awareness of BIM, it is important to know how many of them are seriously planning to take the crucial step of adopting the new technology. Based on the above figure, nearly half of the non-users indicate that they will adopt the technology in the future. However, the same amount of respondents replied that they are still undecided over the implementation of BIM. Though this may not seem overwhelmingly positive, there is a chance that there could be a positive change of thought in the future. Only a mere 4% have clearly decided against the usage of BIM in the future.

5 Cross Tabulation

For this survey, cross tabulation analyses were carried out as to examine the correlation and connection between different attributes. The holding attributes include size and income of architecture firms, types of software used and experience in BIM.

Q7 When producing CAD drawings, which of the following software do you mainly use?

Answered: 61 Skipped: 6



Software selection (Q7) and (Q8). Based on the software used by the respondents, it is clear that big firms with more staff have used BIM technology more than the small firms. Half of the big firms are using BIM software as their main software for CAD drawings, which is in stark contrast to the small firms where only 2% of them are using BIM software for the production of CAD drawings.

Based on the above figure, the majority of big firms seem to use BIM software as their second most used software, while small firms have Sketchup as their second most used software. This shows that the big firms have started to invest and adopt BIM while the small firms are still using traditional drafting software such as AutoCAD and conventional 3D software such as Sketchup.

BIM adoption (Q12). The respond to this question shows that the percentage of BIM users among the big firms is way much bigger as compared to the percentage of BIM users among small firms. As compared to the other BIM reports from around the world, this trend strengthens the claim that bigger firms are more capable and willing to invest in this technology [1], [13], [14], [15].

including government institutions, agencies, organizations and education institutions must participate and work together to achieve this target.

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BIM user (Q13). The current trend to BIM adoption suggests that the adoption rate of the technology increases in parallel to the size of architecture firms. This trend has so far proved to be in line with trends from other sides of the world including the US, UK and Middle East based on their annual BIM reports.

6 Conclusion

BIM usage continues to grow around the world and many more high profile construction projects are seen to be using BIM throughout the design, construction and operation phase. It is a positive sign that more than 80% of the architecture firms in Malaysia are aware of BIM and its benefits. However, it trails behind many other developed countries in terms of adoption as only 20% of the architects firms in Malaysia are currently using the technology.

The findings from the survey shows that the BIM trend in Malaysia in general is not very different from earlier reports of BIM trends from other parts of the world. In regards to this, the architecture industry in Malaysia has an advantage of learning how America and Europe in particular has developed their strategies and roadmaps towards full implementation of BIM. The architecture industry in Malaysia can also avoid the mistakes and mishaps that had happen in those countries and try to strategize for a better roadmap towards full BIM implementation. For this to happen, all parties

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